Received 24 December 2024
Revised 11 May 2025
Accepted 14 June 2025

Roundtrip feedback in open data portals: analysis of input and output channels

Abdul Aziz
Aragon Institute of Engineering Research (I3A), Universidad de Zaragoza, Zaragoza, Spain
Mohsan Ali
Department of Information and Communication Systems Engineering, University of the Aegean, Samos, Greece
Javier Nogueras-Iso
Aragon Institute of Engineering Research (I3A), Universidad de Zaragoza, Zaragoza, Spain
Charalampos Alexopoulos
Department of Information and Communication Systems Engineering, University of the Aegean, Samos, Greece, and
Francisco J. Lopez-Pellicer
Aragon Institute of Engineering Research (I3A), Universidad de Zaragoza, Zaragoza, Spain

Abstract

Purpose – Open Government Data (OGD) portals aim to enhance accountability and transparency by serving as central access points for all government data at local, regional and national levels. To enhance user engagement with OGD portals, it is essential to optimize feedback mechanisms within these portals. This work aims to analyse the current status of feedback mechanisms as a foundation for their future improvement to strengthen user engagement and to advance in accountability and transparency.

Design/methodology/approach – This research conceptualizes feedback mechanisms in OGD portals, followed by case studies and extrapolation through the analysis to a wider range of OGD portals by means of an automated detection of input channels, output channels and the connecting flows.

Findings – The study reveals significant variability in the structure and formality of input and output feedback channels. Feedback mechanisms range from highly informal channels, such as social media, to formal structured channels, such as dedicated feedback forms. Our data analysis identifies three distinct clusters of countries based on the characteristics of feedback mechanisms in their OGD portals.

Originality/value – While existing research highlights the importance of feedback in OGD portals, it mainly focuses on the flow from users to data publishers through input channels. The novelty of this work lies in examining not only input channels but also the return flow from data publishers to users through output channels.

Keywords Open government data, Open data portal, User feedback, Inclusive open data ecosystem, Heterogeneous feedback mechanisms

Paper type Research article

Funding: This work is supported by the ODECO project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement no. 955569.

Online Information Review
Vol. 49 No. 8, 2025
pp. 134-151
Emerald Publishing Limited
e-ISSN: 1468-4535
p-ISSN: 1468-4527
DOI 10.1108/OIR-12-2024-0807

1. Introduction

An increasing number of countries across the world have started making Open Government Data (OGD) accessible to the public freely and in various formats via a variety of open data portals (Simperl and Walker, 2020; Lnenicka and Nikiforova, 2021). The main objective is to enhance the transparency of government operations and actions and to promote the notion of generating value from OGD (Jetzek *et al*., 2013; Ishengoma and Shao, 2025). In order for users to be successful in achieving this objective, users must be able to grasp the narratives behind the published data and extract knowledge from them (Chokki and Vanderose, 2023). Currently, a high level of data literacy and experience is commonly required for extracting insights from data (Gascó-Hernández *et al*., 2018; Chua *et al*., 2020), which means that we still have a long way to go before we achieve the goal of user engagement within open data portals. Therefore, one viable way to bridge the gap in user engagement and improve the data quality is to offer an interactive dialogue between users and providers (or data intermediaries).

According to Zuiderwijk *et al*. (2014), an open data ecosystem is defined as the network of interconnected stakeholders, institutions, infrastructures, and technologies that support the publishing, access, use and reuse of open data, emphasizing the evolving relationships among data providers, users and the systems that enable the data flow. Feedback mechanisms are a crucial part of open data ecosystems, as they allow users to provide their opinion in the form of feedback on the data and on the portal itself. This feedback can be used to improve the quality of the data and the portal, and to make the data more accessible and useable for users (Dawes *et al*., 2016). Similarly, it is also important for open data portal administrators to know what are the most effective methods for providing feedback to enhance the quality of data (European Commission report, 2016).

Feedback mechanisms have the potential to enhance government operations and monitoring methods, thereby advancing openness, accountability and citizen engagement (Wirtz *et al*., 2019). However, existing feedback methods in open data ecosystems are not meeting the different demands of the stakeholders, preventing optimum usage and reuse of data and also there is a gap in knowing how feedback is handled and integrated into open data systems to encourage data reuse and improve the data quality (Zuiderwijk and Janssen, 2014; Attard *et al*., 2015; Wilson and Cong, 2021; Ruijer and Martinius, 2017; Johnson, 2016). Hence, it is important to note that there is a need to identify the interests of various stakeholders to modernise these feedback mechanisms in open data portals. Addressing these concerns is essential for improving open data accessibility, usefulness and relevance and boosting data-driven decision-making in numerous fields.

The main motivation for this work is to understand the current challenges of providing feedback. For this analysis, we propose a methodology based on three main stages. First, we define a conceptual framework for feedback scenarios in open data portals where two main stakeholders interact: governments in their role of data publishers, and final users with a generic profile. This framework is designed to define the feedback mechanism, how it operates, facilitating continuous improvement and adaptability in open data initiatives. Our aim is to provide a structured understanding of feedback scenarios, addressing both the needs of data publishers and users. Second, this conceptual framework is then improved through the analysis of five case studies using structured questionnaires. By employing a mixed-methods approach and incorporating the data from the case studies of five open data portals, we examine how feedback scenarios are implemented and maintained across the portals. This validation strengthens the theoretical foundations of our feedback model. Thirdly, focusing on the identification of input and output channels for feedback, we have extrapolated the analysis of feedback mechanisms across the 29 open data portals, including 26 European open data portals. This broader analysis allows us to generalize the feedback scenario for a wider range of open data initiatives, highlighting commonalities and divergences across different portals.

The rest of the article is structured as follows. Section 2 provides a review of the research background and relevant literature. The methodology that includes the framework of the working model is presented in Section 3. Section 4 presents the findings and results of this

research, which are discussed in Section 5. Finally, Section 6 provides some concluding remarks, together with a description of the limitations of this research work and some ideas for future work.

2. Related work

This section compiles some relevant works related to feedback and its role in Open Data ecosystems. Although this article does not aim to provide a systematic review, we followed some of the steps in traditional methodologies for systematic reviews, such as SALSA (Booth *et al.*, 2016) and PRISMA (Page *et al.*, 2021), to find relevant resources. These steps included: identifying databases to search (Web of Science, Scopus, ScienceDirect, and Google Scholar); defining the search strategy (using terms like "feedback loop", "open data feedback", "data portal feedback" and "feedback channels"); establishing inclusion/exclusion criteria; and finally synthesizing the contributions of the work with respect to our research. After applying this process, we were able to classify the contributions into three categories: (1) works justifying the need for and importance of feedback; (2) works identifying different channels for providing feedback and (3) works identifying the issues subject to get feedback.

Due to the expansion of OGD initiatives and the efforts of governments to make open data ecosystems more user-centric (Dawes and Helbig, 2010; Janssen *et al.*, 2012; Alexopoulos *et al.*, 2014), feedback mechanisms have been a longstanding topic in the domain of OGD. Since the middle of the last decade, several researchers have highlighted that open data infrastructures should have a feedback mechanism in place to facilitate the communication between OGD providers and users (Alexopoulos *et al.*, 2014; Susha *et al.*, 2015) and enhance their transparency (Klein *et al.*, 2018; Lněnička *et al.*, 2021). In general, the availability of feedback channels is considered as a relevant factor influencing the increase in the quality of OGD portals (Kubler *et al.*, 2018; Zhu and Freeman, 2019). Moreover, these feedback channels should be bidirectional. According to Janssen and Helbig (2018), to engage stakeholders in an effective way in public discussions around the OGD, policy-making, and creation of application services, it is essential to have a communication and interaction channel that establishes feedback loops between data publishers and data users. This allows consumers to rate open data and the providers to respond to their comments. Emphasizing this bidirectional character of feedback, Purwanto *et al.* (2020) mention feedback in open data initiatives as a main citizen engagement factor with the availability of feedback channels and means of communication among data users and publishers, including follow-up communication. In addition, it is acknowledged that open data ecosystems are systems in constant evolution as user needs and preferences change over time. In order to support the sustainable development of the infrastructure associated with these ecosystems, feedback processes are essential to track this change in user behaviour (Lnenicka and Machova, 2024).

With respect to the diversity of feedback channels, Máchová *et al.* (2018) have proposed a framework for evaluating the usability of open data portals where the availability of feedback channels is considered a relevant criterion. Among the options available for users to submit feedback, they identify discussion forums, contact forms, user ratings, dataset comments and social media. In particular, social media is acquiring an increasing relevance in the last few years to increase the communication between data publishers and users (Gunawong, 2015; Publications Office of the European Union, 2021; Aziz *et al.*, 2024). Although social activity is mostly originated by data publishers and creators for dissemination purposes (Khan *et al.*, 2021), social networks are an independent forum where any stakeholder may share their perspectives. In addition, more dedicated channels can be employed to address specific objectives. For instance, the European Data Portal performed surveys and interviews to assess the user experience with the portal (Publications Office of the European Union, 2020). Whereas survey questionnaires allow a quick response on a specific issue from a broad audience, interviews with individuals can help to obtain detailed insights. For instance, Zhang

et al. (2022) used interviews as a methodology for identifying incentive mechanisms in the implementation of OGD.

About the issues communicated by users through feedback channels, Zuiderwijk *et al*. (2016) have investigated the design of OGD infrastructures where interaction mechanisms are a key element. By designing these interaction mechanisms, they identify the main topics of the issues reported by users: requests for new datasets, requests on existing datasets (e.g. errors or lack of the desired formats), feedback to policy makers, information related to a dataset (e.g. publications and applications based on the dataset), data use cases or technical experienced with the use of the infrastructure. Máchová *et al*. (2018) and Nikiforova (2020) also confirm these topics in the results of their assessment of open data portals. The only remarkable difference is that apart from the reporting of use cases about the exploitation of data, they also consider simple dataset ratings or view/download statistics.

3. Research methodology

Figure 1 highlights the details of our proposed methodology. Our methodology is organized into three separate stages: conceptual definition of the feedback scenario; instantiation through

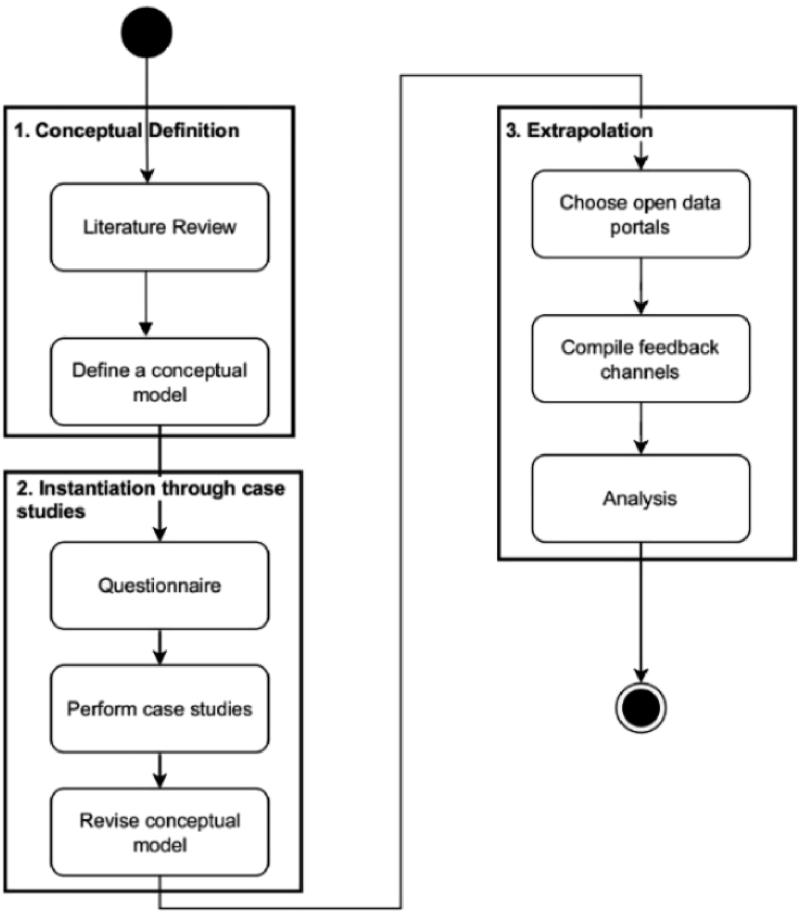

Figure 1. Proposed research process for feedback mechanism. Source: Authors' own work

case studies; and extrapolation to other open data portals. Each stage builds on the one that came before it to develop an in-depth comprehension of the feedback mechanisms that are present in open data portals. The following subsections explain these stages.

3.1 Definition of the conceptual scenario of feedback mechanisms

Initially, a literature study is conducted with the objective of creating a basic and conceptual model of feedback processes within the framework of open data. This conceptual model is then refined during the second phase through case study analysis. This way of proceeding is inspired by the design science research methodology. According to Venable and Baskerville (2012), this methodology is the "research that invents a new purposeful artefact to address a generalised type of problem and evaluates its utility for solving problems of that type". Within the context of our work, the conceptual scenario acts as the artefact whose utility is evaluated through the instantiation of case studies and the extrapolation to other open data portals.

3.2 Instantiation through case studies

In this phase, we design questionnaires for the administrators of national open data portals, aligning them with our conceptual scenario of the feedback mechanism. Apart from preparing the questionnaire, we need to define the target audience of our survey, i.e., which national data portals will receive our survey and how we can contact them. During this phase, the objective is to study the functioning of feedback mechanisms in practice and to discover the elements that influence the efficiency of certain feedback mechanisms. Our assumption is that we can improve the original conceptual model by incorporating the insights that we gain from these real-world implementations. This enables us to update the model so that it accurately reflects the feedback implementation and user engagement methods and systems in open data contexts.

3.3 Extrapolation to other open data portals

Desk-based research must be conducted as part of the third and final phase of this study, with the aim of extrapolating the results from the case studies to a wider variety of open data portals. For this purpose, it is necessary to analyse the portal features related to feedback that are accessible to the public through various open data portals. The goal is to determine whether the modelling of feedback scenarios could be applied more generally across different contexts. In addition, it must be noted that as it is impossible to investigate all the steps of a feedback scenario without the direct information obtained by the administration staff of open data portals, this third stage is focused on analysing the feedback flows between data users and providers through the identification of input channels (feedback requests sent by users to data publishers) and output channels (feedback replies returned by data publishers to users).

This stage of the methodology consists of three steps: selection of open data portals, compilation of feedback channels and analysis. Although the selection of open data portals is obviously a personal decision of the experts performing the study, the compilation and analysis steps can be guided by a partially automated procedure.

For the compilation, we must identify different types of input/output channels as shown in Table 1, which presents the feedback channels (input, output and both) identified in this research study for open data portals, along with the technique used to determine them. Input feedback channels are the identified feedback channels through which users can actively provide direct feedback on datasets, services, or portal features. These channels are designed to capture user perspectives, suggestions and ratings that help in assessing user needs and portal performance. Output feedback channels are primarily used by the portal team to communicate updates, information, and announcements to the users. While users may not provide direct feedback through these channels, they offer indirect insights into user engagement based on how users interact with the shared content. Last, input/output feedback channels serve as both

Table 1. Feedback channels and their determination methods

Channel	Input	Output	Detection method
E-mail	X		Automated: via regex pattern `\b[A−Za−z0−9._%+−]+@[A−Za−z0−9.−]+.[A−Z
Feedback form	X		Automated: Identified <form> tags with keywords like "feedback" in labels, buttons, or URLs
Survey	X		Manual
Interviews	X		Manual
Dataset Like/Rate/Fav	X	X	Manual
User/Discussion Forum	X	X	Manual
Social Media	X	X	Automated: Detected links for Twitter or Facebook etc
Blog/News		X	Manual
Newsletter		X	Manual

Source(s): Authors' own work

feedback collection points and information-sharing platforms. Users can engage with the platform by both receiving updates and providing feedback through comments or discussions.

With the purpose of automating this compilation step, we have prepared a Python-based script web-scraper, available in a GitHub repository (IAAA Lab, 2025), that explores the website of OGD portals and generates a draft list of potential channels, which must be manually verified later by experts.

Finally, we propose the development of a series of artefacts in order to analyse and compare the status of various open data portals. First, we suggest a comparison of OGD portals in terms of the number and diversity of employed channels through a bar chart. Second, it is interesting to compare the frequency of employment of each channel in an OGD portal with an area chart. Third, we can provide a cluster analysis of OGD portals by grouping the portals based on their similarity in the employment of different channels. Fourth, we can provide a fine-grain analysis to investigate if the feedback channels are provided for reporting issues on specific datasets or the portal as a whole by means of a specific bar chart. Last, we can analyse the potential flows connecting input and output channels co-occurring in an OGD portal with a Sankey diagram.

4. Results

This section presents the findings of our research, highlighting key outcomes and trends observed throughout the study. The results are arranged following our methodology, beginning with a comprehensive overview of the conceptual definition of the feedback mechanism and followed by detailed analyses through case studies that offer insights into the conceptual model. This approach is designed to address each research objective. Finally, we conducted an extrapolation to more extensive open data portals to analyse the feedback mechanisms across these portals.

4.1 Conceptual scenario of feedback mechanisms

As described in the proposed methodology, we first dig deep into the conceptual model of feedback scenarios from the literature and the overall results of this research study. Sieber and Johnson (2015) investigated the importance of civic feedback in open data ecosystems and argued that successful portals need to complete the feedback loop by converting user input into improvements that can be implemented directly. Moreover, the authors provide a criticism of the one-way transmission of data and argue in favour of communication procedures that are

bidirectional. Likewise, Veljković *et al*. (2014) proposed a criterion for assessing the feedback scenarios where the authors stressed the need to include the main participatory feedback elements, such as dataset comments and dataset issues tracker with proper responses.

For this research study, Figure 2 presents the general modelling of feedback interaction and depicts the feedback interaction process between the data user and the data publisher inside the portal. The process starts with the data user defining a feedback message, which is then sent through an input channel. Depending on the selected input channel, the message is also broadcast to other users. The procedure thereafter diverges according to the policies established by different data publishers. If transparency is promoted by data publishers, the

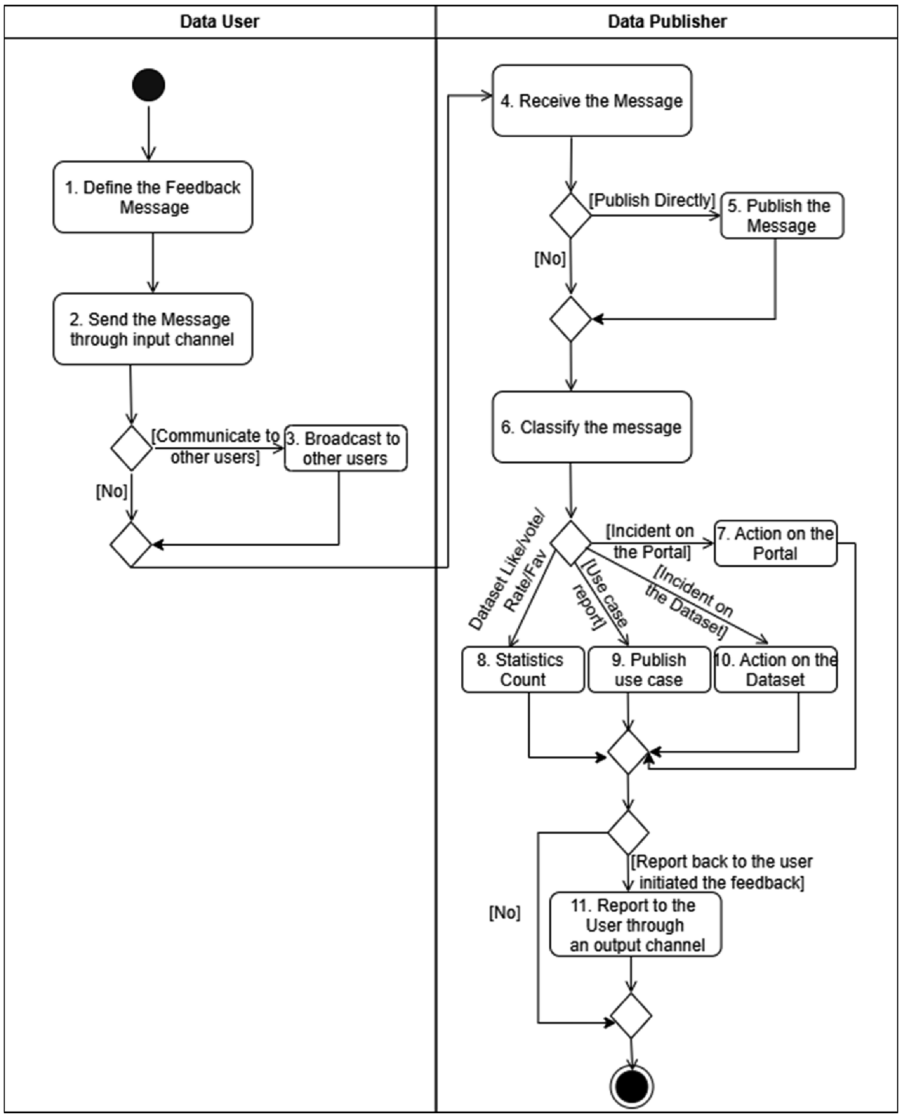

Figure 2. General modelling of feedback interaction. Source: Authors' own work

received messages are directly published. Otherwise, the feedback undergoes classification, where it is assessed to determine if it is an incident related to the portal or the dataset. For portal incidents, an action is taken directly on the portal, while dataset-related incidents trigger actions on the dataset itself. Additional steps, such as statistical tracking and reporting on use cases, follow as appropriate. Finally, the process concludes with the feedback loop, where an output channel reports back to the original user who initiated the feedback, providing them with updates or outcomes resulting from their input. This feedback interaction scenario shows the foundational working of a feedback mechanism throughout an open data portal. It offers a paradigm for evaluating the integration of feedback into portal operations.

4.2 Instantiation through case studies

Having the conceptual model of the feedback scenario ready, we wanted to validate whether it was reflecting the reality, i.e. how the various national open data portals are dealing with feedback. Therefore, we prepared a questionnaire for open data portal administrators. This allowed us to get more comprehensive insights. To communicate our inquiry to the administrators of the open data portals, we compiled the official email addresses of the administrative teams and sent them an email with the following questions:

(1) **Q1**: Which input channels are facilitated for users to provide feedback?

(2) **Q2**: How does your team review, classify and prioritize feedback from various input channels?

(3) **Q3**: How does your team handle feedback classified as an incident related to the portal or datasets? What specific actions are taken based on these classifications?

(4) **Q4**: How are users informed about actions taken in response to their feedback, i.e. what are the output channels for feedback?

Although we sent our questionnaire to the administrative teams of 29 OGD national data portals (the portals listed in Table 3), we got only responses from the administrative teams of 5 European open data portals: Estonia, Sweden, Luxembourg, Poland and Spain. We have summarized the answers we received and mapped the responses according to our conceptual model (presented in Figure 2) in Table 2.

In the case of Estonia, its open data portal offers a straightforward yet underdeveloped system, where feedback is limited in volume and structured mostly around direct dataset concerns. Feedback primarily comes in the form of comments and direct emails from users, addressing dataset-specific errors or accessibility issues. The feedback mechanism lacks broadcasting and categorization features, limiting how feedback can be structured or classified. Despite this simplicity, the portal shows a commitment to user engagement, enabling users to comment on data quality while allowing portal administrators to assess and respond accordingly.

In the case of Luxembourg, its open data portal lacks a systematic process, handling feedback on a case-by-case basis without formal analysis. Feedback is received through various channels, allowing users to comment on data format, accessibility and other technical issues, which are forwarded to data producers or portal administrators for response.

Poland open data portal provides a comprehensive platform that integrates various feedback options to enhance user interaction. This portal has developed a robust feedback infrastructure that encompasses multiple input channels and emphasizes collaborative feedback review by portal and technical teams. User feedback, gathered through dataset comments, dedicated emails and new data requests, informs actions aimed at improving data quality and addressing user needs. Although explicit feedback assessment techniques are not highlighted, the portal employs diverse input strategies, benchmarking against European standards to continuously adapt and improve. This approach reflects a comprehensive commitment to understanding user requirements and implementing solutions, demonstrating a forward-looking stance on open data engagement.

Table 2. Comparative summary of feedback interaction processes across five European open data portals

Step no.	Step description	Estonia	Luxembourg	Poland	Sweden	Spain
1	Define the Feedback Message	Specific questions or dataset concerns	Case-by-case; format, access, updates	Dataset comments, new data requests	Data requests, API issues	Dataset comments, new initiatives
2	Sending the Message	Email, forum, rating	Email, forums, favourite/reuse marking	Surveys, feedback forms, email	Interactive dashboard, comment threads	Feedback/ request forms
3	Broadcast to other users	Not applicable	Forum only	Not applicable	Public community forum	Public comments, social media
4	Read the Message	Admins assess issues	Technical team collaborates with data producers	Team and officers assess feedback	Team and community members read and engage	Admins and responsible bodies review
5	Publish the Message	Not usually published	Managed internally, not published	Not public	Immediately published in threads	Visible on dataset pages
6	Classify the Message	By theme (e.g. errors)	Not formally classified	No specific methods	Eleven predefined topics	Categorized (e.g. incidents, data requests, use cases)
7	Action on the Portal	Focus on portal usability	Mostly accessibility, scalability improvements	Steps to improve data quality	Some feedback leads to portal improvements	Incident handling, platform improvements
8	Statistics Count	User star ratings updated	Favourite/reuse counts updated	Not applicable	Tracks posts and participants by topic	Likes updated and shown
9	Publish Use Case	Sometimes use cases are generated	Not indicated	Benchmarking with other portals	Not explicitly published	Successful use cases shown publicly
10	Action on the Dataset	Dataset corrections based on feedback	Mostly format and update issues	Data quality improvements	Dataset actions arise from discussion	Dataset requests relayed to providers
11	Report to the User	Private reports, ratings are public	Not systematically reported	No mention of response	Transparent, real-time discussions	Public responses or private follow-ups depending on type

Source(s): Authors' own work

The Swedish portal emphasizes community engagement through a structured, interactive feedback dashboard, where users can participate in discussions categorized into distinct topics. Eleven themes structure the discussions, and the portal tracks engagement through metrics like participant profiles and post counts, providing insights into active areas, such as data access and API requests. The portal's hierarchical feedback organization allows administrators to better understand and address user needs across various levels.

The open data portal of Spain stands out as a highly integrated and structured feedback system within the open data landscape. Through multiple channels, including data requests,

Table 3. Open data portals by country

Country	Acronym	Open data portal URL
Australia	AU	data.gov.au
Austria	AT	data.gv.at
Belgium	BE	data.gov.be
Bulgaria	BG	data.egov.bg
Canada	CA	open.canada.ca
Croatia	HR	data.gov.hr
Cyprus	CY	data.gov.cy
Czech Republic	CZ	data.gov.cz
Denmark	DK	opendata.dk
Estonia	EE	avaandmed.eesti.ee
Finland	FI	avoindata.fi
France	FR	data.gouv.fr
Germany	DE	govdata.de
Greece	GR	data.gov.gr
Ireland	IE	data.gov.ie
Italy	IT	dati.gov.it
Latvia	LV	data.gov.lv
Lithuania	LT	data.gov.lt
Luxembourg	LU	data.public.lu
Malta	MT	open.data.gov.mt
Netherlands	NL	data.overheid.nl
Poland	PL	dane.gov.pl
Portugal	PT	dados.gov.pt
Romania	RO	data.gov.ro
Slovakia	SK	data.gov.sk
Slovenia	SI	podatki.gov.si
Spain	ES	datos.gob.es
Sweden	SE	dataportal.se
United States	US	data.gov

Source(s): Authors' own work

application sharing and comments on datasets, users can influence content, and the portal administrators incorporate this feedback into catalogue expansions and continuous improvements. With a variety of specialized support mechanisms and tools, Spain's open data portal not only encourages user engagement but also systematically translates user suggestions into platform updates. This comprehensive feedback system, combined with proactive input collection from both the public and institutional users, enables data.gob.es to dynamically adapt to user needs and maintain relevance in the open data ecosystem.

4.3 Extrapolation to other open data portals

Once we have analysed in detail the feedback within five specific case studies, the objective of this third phase of the study is to extrapolate the analysis into a wider variety of open data portals. We have chosen 26 European national open data portals, along with the Australian, US, and Canadian open data portals, as shown in Table 3. As in this extrapolation exercise, it is not possible to obtain detailed information for all the steps in the feedback scenario, we have focused on analysing the feedback flows between data users and providers through the identification of input channels and output channels.

To accomplish this objective, it was necessary to investigate the open data portals to find the way users interact with the data and provide feedback. Using the web-scraping method described in Section 3.3, we generated an initial list of channels for each OGD portal. Then, we

personally visited each open data portal to collect the rest of the feedback channels, alongside confirming the automated feedback channels. Figure 3 shows how many feedback channels each respective national open data portal has, and it provides insights into the diversity and extent of feedback channels available for users to engage with the open data portals. The height of each bar in the chart stands for the number of feedback channels that are linked with a particular open data portal. France and Poland have the biggest number of feedback channels on their respective open data portals.

On the other hand, we can observe that the open data portals in Malta and Greece have the fewest number of feedback channels. As a result, Figure 3 highlights that the more feedback channels an open data portal has, the more chances there are for user involvement to connect with the open data portal. To enhance user engagement, it is essential to ensure that feedback mechanisms within the open data portal are used to their fullest potential. Likewise, Figure 4 illustrates the probability of including one of the nine feedback channels identified in Table 1. When the number on the *y*-axis is higher, such as when it is 0.9, it indicates that the linked feedback channel, which includes social media and Feedback Form, is utilized to a significant degree across most national open data portals. However, the lower values, such as 0.15 and 0.25, for channels such as Discussion Forum and Survey correspondingly, suggest that these channels are employed less often among the open data portals. This is the case since these channels are less often used. Furthermore, by utilizing this visual depiction of Figure 4, we can ascertain, in brief, the number of individuals who are utilizing the various feedback channels and the level of popularity that they possess.

Moving further, Figure 5 depicts the dendrogram resulting from a hierarchical clustering analysis of countries based on their feedback channels. Hierarchical clustering was employed to group countries with similar feedback setups, using Ward's linkage method to minimize the variance within each cluster. In the dendrogram, each leaf represents a country and the branches illustrate the merging process of the clustering algorithm. The height of the branches corresponds to the dissimilarity (Euclidean distance) between countries or clusters. This dendrogram provides a visual understanding of the clustering process. Countries with shorter branch lengths between them share similar feedback channel patterns. The cutoff line at a specific height [3.0] is used to segment the data into distinct clusters, facilitating the

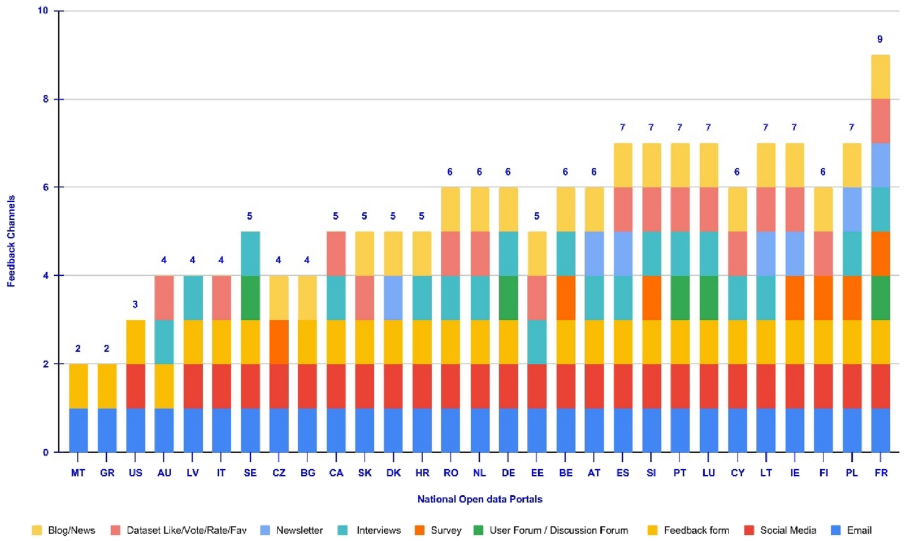

Figure 3. Feedback channels of national open data portals. Source: Authors' own work

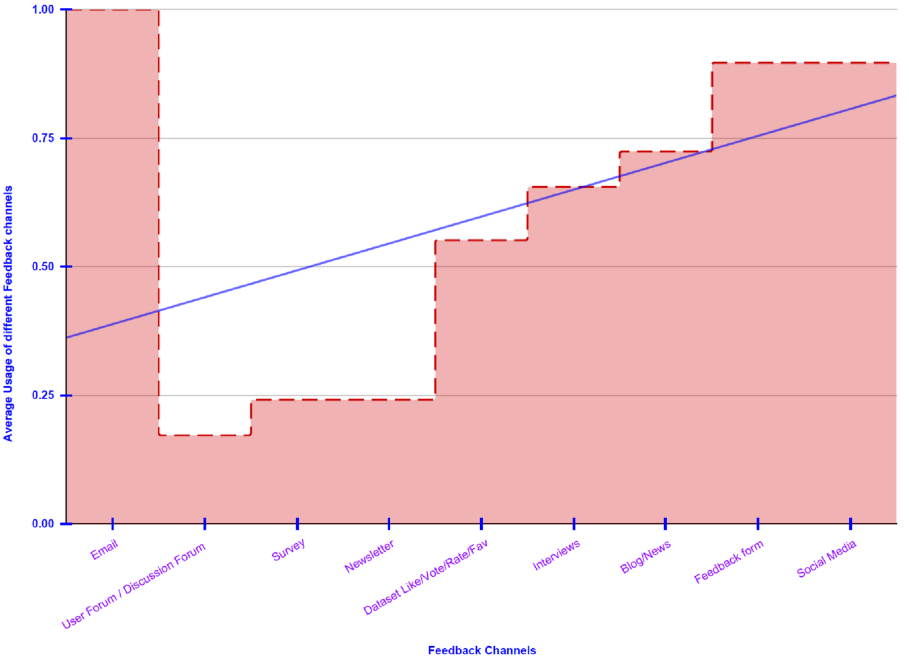

Figure 4. Average number of times different feedback channels offered by open data portals. Source: Authors' own work

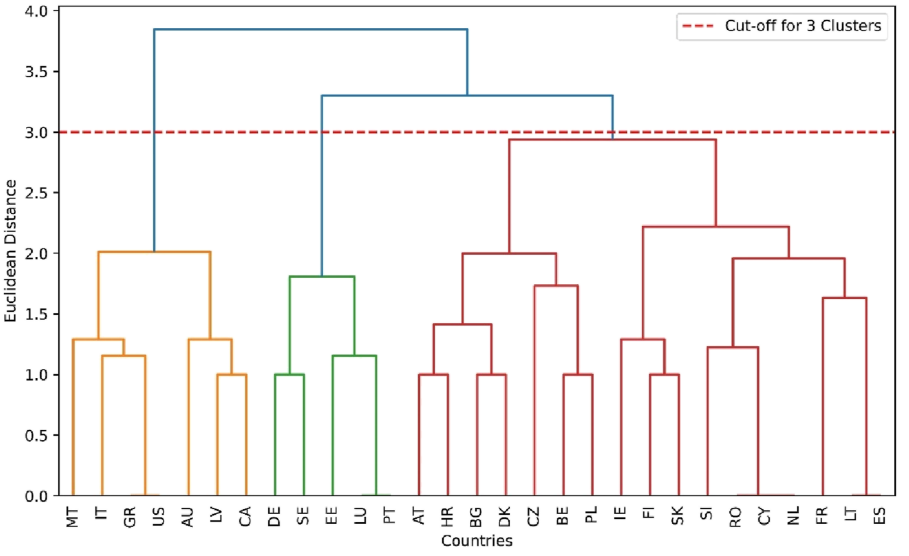

Figure 5. Dendrogram of countries based on feedback channels. Source: Authors' own work

interpretation of the results. These clusters reflect the varying strategies and preferences of countries in utilizing feedback mechanisms, such as email, surveys and social media, for input and output communication. Moreover, it is necessary to see the cluster profiling as it provides a

deeper understanding of the formed clusters and their distinguishing characteristics. This step not only helps to interpret the results but also reveals actionable insights by highlighting key differences and similarities across clusters. Hence, Figure 6 shows the cluster profiling of countries based on feedback channels. The colour scheme used for cluster profiling is the same as that used for the dendrogram. For instance, the green colour represents cluster 2 and the countries in cluster 2 are Germany, Sweden, Estonia, Luxembourg and Portugal. Moreover, it can also be seen that cluster 2 countries lack feedback channels, such as a survey and newsletter.

Furthermore, Figure 7 shows the details and usage of the feedback channels (email and feedback form) at both the dataset level and the portal level for the chosen open data portals. It is possible to have a better understanding of the considerable distinctions that exist across the various national open data portals by reading this graphical representation. In particular, the United States of America, Canada, the Netherlands and Australia stand out as having a complete feedback infrastructure that includes all four feedback channels. These channels are referred to as "Email at Portal Level", "Feedback Form Portal Level", "Email at Dataset Level" and "Feedback Form Dataset Level".

Last, Figure 8 illustrates the potential connections between input feedback channels and output feedback channels, considering the co-occurrence of the channels in the different countries. The thickness of the connecting flows represents the number of countries having such a pair of input and output channels. Before making the relationship, we have thoroughly examined the input and output feedback channels to assess not only the dependency of the input and output feedback channels, but also which channels should be considered as input, and which should be considered the output based on the nature of the feedback channel. For instance, in Figure 8, it can be seen that "Dataset Like/Vote/Rate/Fav" can only be the output of "Dataset Like/Vote/Rate/Fav". That is to say, once a user confirms a like for a dataset, other users can see how many users have marked that dataset as liked/rated/favourite, but this channel cannot be the output of a previous email input.

In general, Figure 8 highlights how certain input channels, such as email, feedback forms and social media have thick flows connecting them to multiple output channels, indicating their widespread adoption and versatility in feedback mechanisms. In contrast, channels like surveys and User Forum/Discussion Forum features exhibit more targeted and less widespread connections, suggesting specialized usage. The diversity in flow thickness reflects the probability of the occurring flows.

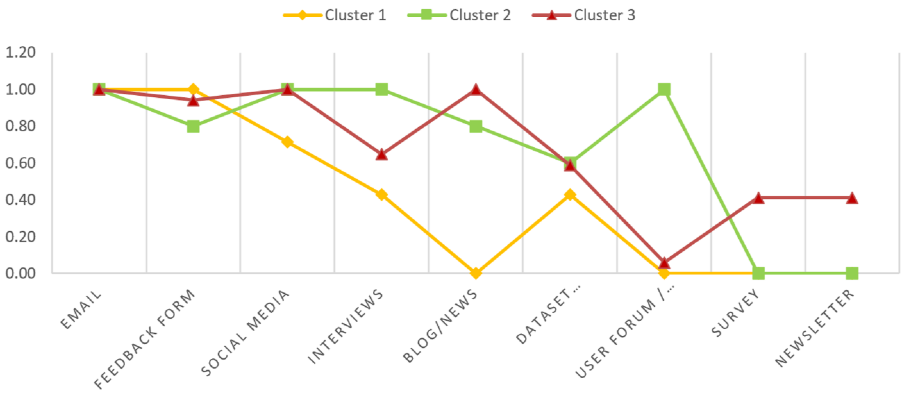

Figure 6. Cluster profiling of countries based on feedback channels. Source: Authors' own work

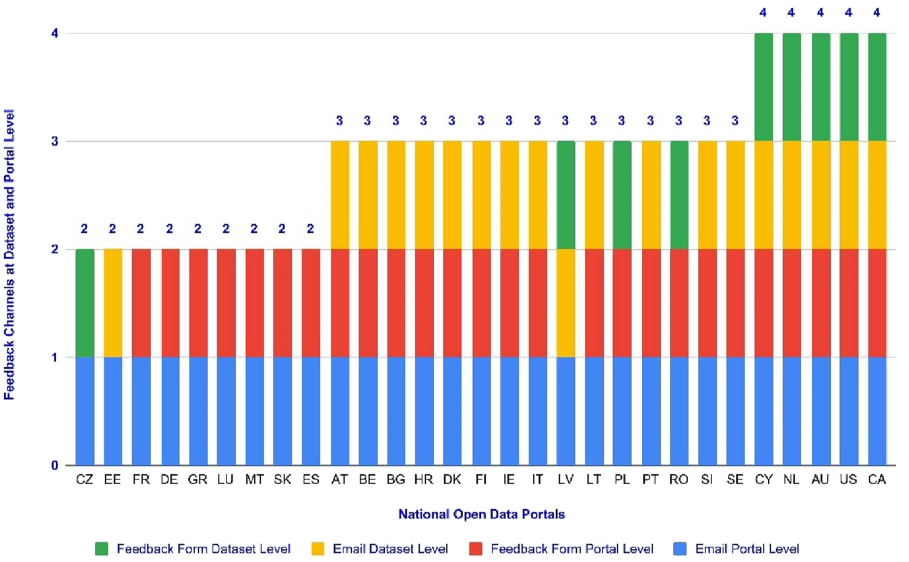

Figure 7. Input feedback channels at dataset level and portal level. Source: Authors' own work

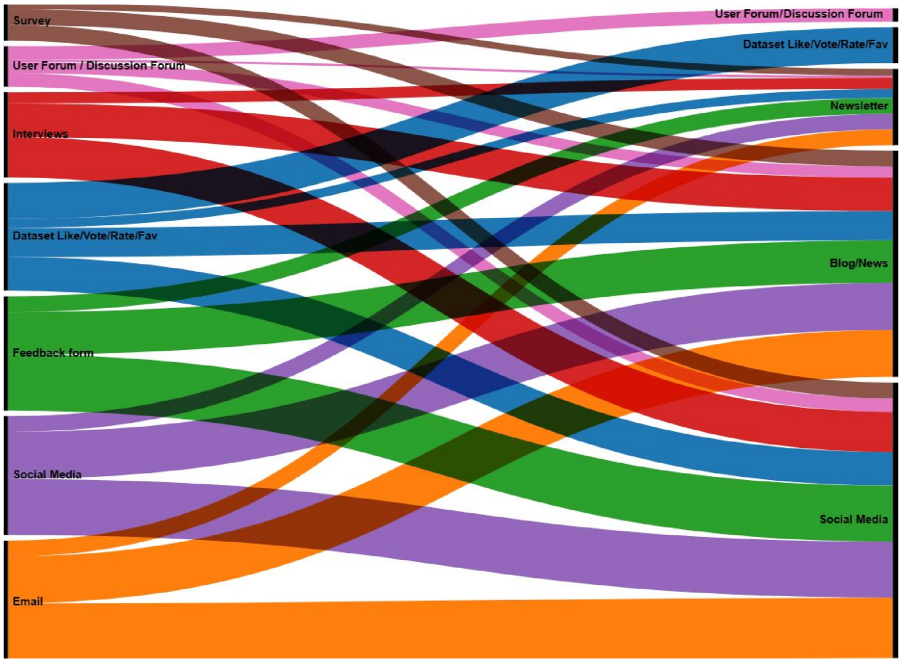

Figure 8. Relationship between input and output feedback channels across various countries. Source: Authors' own work

5. Discussion

The findings reveal that open data portals employ diverse feedback channels, each serving unique interaction purposes. Input feedback channels such as email, feedback forms, comments and dataset ratings provide users with direct means to express their specific needs, suggestions, and concerns. These channels are invaluable in capturing granular user perspectives that inform data quality and portal improvements. Output feedback channels, including blogs and newsletters, are primarily one-way communication tools designed to disseminate updates and announcements. While they play a critical role in maintaining user awareness, they do not facilitate interactive engagement. Input/output channels like social media and discussion forums, on the other hand, serve as bi-directional platforms that enable real-time interactions and foster collaborative contributions from users. In addition, it must be noted that, except for the specific five cases reported in Section 4.2, the flows in Figure 8 only reflect potential connections between the feedback received through input channels and the responses addressing these inputs that can be conveyed through the available output channels of an OGD portal. In order to have a real evidence of the internal process for managing feedback, we should have direct communication with the administrative teams of every portal.

Anyway, our analysis highlights the varying levels of sophistication in feedback classification and prioritization mechanisms across portals. Structured methods, such as those used by the Swedish Open Data Portal, categorize feedback into specific topics and track user engagement metrics like the number of posts and participants. This systematic approach facilitates the prioritization of feedback and enhances the ability of administrators to act on user concerns effectively. In contrast, portals such as those in Estonia and Luxembourg often rely on ad hoc feedback management processes, which may lead to inefficiencies in addressing user needs. The lack of formal classification frameworks in these cases limits the scalability and effectiveness of feedback processing. Moreover, feedback is essential for facilitating improvements at both the portal and dataset levels. For example, portals in Spain and Poland integrate user recommendations into new data efforts, apps, and upgrades. These acts illustrate the capacity of feedback to improve the relevance and accessibility of data. Nonetheless, the research indicates that several open data portals fail to consistently communicate the results of user input. Concluding this feedback loop is vital for establishing user trust and promoting user involvement. By offering updates or replies to user comments, portals may illustrate the significance attributed to user contributions and build a stronger relationship with their user base.

6. Conclusions, limitations and future research

Understanding the feedback mechanisms in open data platforms is crucial for evaluating their effectiveness in promoting the quality of data and user participation. We tested the feasibility of our methodology by designing a comprehensive conceptual definition of feedback mechanism through the literature review, a refinement through specific case studies, and the extrapolation of the feedback analysis through the automated study of input and output channels offered by 29 open data portals, which included 26 OGD initiatives from Europe. This study analysed feedback interaction processes focusing on mechanisms for collecting, categorizing, and utilizing user feedback to improve data quality, data accessibility, usability and overall portal effectiveness.

The findings of this study have direct and practical implications for the management of OGD initiatives. OGD portals of countries incorporated in the extrapolation phase, or in general, OGD portals with similar features, can compare their status with respect to other countries and decide to change their user engagement policies and enhance their feedback mechanisms. With the guidelines of the input and output channels investigated in this study, the administrative teams of these initiatives may identify channels that are not exploited and initiate communication flows with final users.

Regarding the limitations of our study, it must be acknowledged that one of the limitations of our study was that our research questionnaire was only completed by 17% of the national

portals that were contacted. Part of our future work will be devoted to conducting additional surveys with administrators from the 29 analysed open data portals. These surveys would facilitate the validation of the specified input and output channels and evaluate the success of the connecting flows between them as well as the processing and implementation of user feedback. This step is crucial to ensure that the current understanding of feedback systems aligns with actual practices and operational realities.

Another limitation of our study is that we have not analysed whether we can distinguish the interactions by different types of user groups. Within the scope of this work, we have just considered the general needs for feedback of final users without taking into account whether students, journalists, non-governmental organisations, private companies or open data intermediaries, among other different user groups, interact with an open data ecosystem in a different way. This profiling of users with respect to feedback should be investigated as future research.

Another research line is to explore whether it is possible to establish reliable metrics for evaluating the success of feedback mechanisms. Metrics like feedback response from data publishers, initiating discussion at dedicated discussion forums, and post-submission user satisfaction can provide actionable insights into the effectiveness of these feedback systems. Additionally, community engagement strategies should be prioritized to raise awareness about the availability and importance of feedback channels. Outreach campaigns, co-creation initiatives with users, and targeted efforts to build trust in feedback systems are essential to improving the adoption of the feedback channels.

References

Alexopoulos, C., Loukis, E. and Charalabidis, Y. (2014), "A platform for closing the open data feedback loop based on Web 2.0 functionality", *JeDEM-eJournal of eDemocracy and Open Government*, Vol. 6 No. 1, pp. 62-68, doi: 10.29379/jedem.v6i1.327.

Attard, J., Orlandi, F., Scerri, S. and Auer, S. (2015), "A systematic review of open government data initiatives", *Government Information Quarterly*, Vol. 32 No. 4, pp. 399-418, doi: 10.1016/j.giq.2015.07.006.

Aziz, A., Herrera-Murillo, D.J., Nogueras-Iso, J., Lacasta, J. and Lopez-Pellicer, F.J. (2024), "Identifying the evolution of open government data initiatives and their user engagement", *IEEE Access*, Vol. 12, pp. 84556-84566, doi: 10.1109/access.2024.3414282.

Booth, A., Sutton, A. and Papaioannou, D. (2016), *Systematic Approaches to a Successful Literature Review*, 2nd ed., Sage, Los Angeles, ISBN: 978-1473912465.

Chokki, A.P. and Vanderose, B. (2023), "From conventional open government data portals to storytelling portals: the StoryOGD prototype", *dg.o 2023: 24th Annual International Conference on Digital Government Research*, pp. 642-643, doi: 10.1145/3598469.3598542.

Chua, U.C., Santiago, K.L., Ona, I.B.M., Peña, R.M.N., Marasigan, G.Z.S., Reyes, P.G.A.D. and Samson, B.P.V. (2020), "From access to effective use: open data portals for everyday citizens", *Proceedings of the 2020 Symposium on Emerging Research from Asia and on Asian Contexts and Cultures*, pp. 61-64, doi: 10.1145/3391203.3391219.

Dawes, S.S. and Helbig, N. (2010), "Information strategies for open government: challenges and prospects for deriving public value from government transparency", in *LNCS*, Vol. 6228, Electronic Government, Springer, Berlin-Heidelberg, pp. 50-60, doi: 10.1007/978-3-642-14799-9_5.

Dawes, S.S., Vidiasova, L. and Parkhimovich, O. (2016), "Planning and designing open government data programs: an ecosystem approach", *Government Information Quarterly*, Vol. 33 No. 1, pp. 15-27, doi: 10.1016/j.giq.2016.01.003.

European Commission report (2016), "Enable feedback channels for improving the quality of existing government data", available at: https://data.europa.eu/sites/default/files/report/enable-feedback-channels-for-improving-the-quality-of-existing-government-data.pdf

Gascó-Hernández, M., Martin, E.G., Reggi, L., Pyo, S. and Luna-Reyes, L.F. (2018), "Promoting the use of open government data: cases of training and engagement", *Government Information Quarterly*, Vol. 35 No. 2, pp. 233-242, doi: 10.1016/j.giq.2018.01.003.

Gunawong, P. (2015), "Open government and social media: a focus on transparency", *Social Science Computer Review*, Vol. 33 No. 5, pp. 587-598, doi: 10.1177/0894439314560685.

IAAA Lab (2025), "ODP feedback mechanisms. GitHub repository", available at: https://github.com/IAAA-Lab/ODP-Feedback-Mechanisms

Ishengoma, F. and Shao, D. (2025), "A framework for aligning e-government initiatives with the sustainable development goals", *Journal of Innovative Digital Transformation*, Vol. 2 No. 1, pp. 73-89, doi: 10.1108/jidt-09-2024-0025.

Janssen, M. and Helbig, N. (2018), "Innovating and changing the policy-cycle: policymakers be prepared", *Government Information Quarterly*, Vol. 35, 4, supplement, pp. S99-S105, doi: 10.1016/j.giq.2015.11.009.

Janssen, M., Charalabidis, Y. and Zuiderwijk, A. (2012), "Benefits, adoption barriers, and myths of open data and open government", *Information Systems Management*, Vol. 29 No. 4, pp. 258-268, doi: 10.1080/10580530.2012.716740.

Jetzek, T., Avital, M. and Bjørn-Andersen, N. (2013), "Generating value from open government data", in *ICIS*.

Johnson, P.A. (2016), "Reflecting on the success of open data: how municipal government evaluates their open data programs", *International Journal of E-Planning Research (IJEPR)*, Vol. 5 No. 3, pp. 1-12, doi: 10.4018/ijepr.2016070101.

Khan, N., Thelwall, M. and Kousha, K. (2021), "Measuring the impact of biodiversity datasets: data reuse, citations and altmetrics", *Scientometrics*, Vol. 126 No. 4, pp. 3621-3639, doi: 10.1007/s11192-021-03890-6.

Klein, R.H., Klein, D.C.B. and Luciano, E.M. (2018), "Identification of mechanisms for the increase of transparency in open data portals: an analysis in the Brazilian context", *Cadernos EBAPE.BR*, Vol. 16 No. 4, pp. 692-715, doi: 10.1590/1679-395173241.

Kubler, S., Robert, J., Neumaier, S., Umbrich, J. and Le Traon, Y. (2018), "Comparison of metadata quality in open data portals using the analytic hierarchy process", *Government Information Quarterly*, Vol. 35 No. 1, pp. 13-29, doi: 10.1016/j.giq.2017.11.003.

Lnenicka, M. and Machova, R. (2024), "How intentions to use of OGD and respective portals changed over time: evidence from a three-year study among Czech students", *Online Information Review*, Vol. 49 No. 3, pp. 517-533, doi: 10.1108/OIR-05-2023-0231.

Lnenicka, M. and Nikiforova, A. (2021), "Transparency-by-design: what is the role of open data portals?", *Telematics and Informatics*, Vol. 61, 101605, doi: 10.1016/j.tele.2021.101605.

Lněnička, M., Machová, R., Volejníková, J., Linhartová, V., Knezacková, R. and Hub, M. (2021), "Enhancing transparency through open government data: the case of data portals and their features and capabilities", *Online Information Review*, Vol. 45 No. 6, pp. 1021-1038, doi: 10.1108/oir-05-2020-0204.

Máchová, R., Hub, M. and Lněnička, M. (2018), "Usability evaluation of open data portals: evaluating data discoverability, accessibility, and reusability from a stakeholders' perspective", *Aslib Journal of Information Management*, Vol. 70 No. 3, pp. 252-268, doi: 10.1108/ajim-02-2018-0026.

Nikiforova, A. (2020), "Comparative analysis of national open data portals or whether your portal is ready to bring benefits from open data", *IADIS International Conference on ICT, Society and Human Beings*, pp. 21-23.

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., Shamseer, L., Tetzlaff, J.M., Akl, E.A., Brennan, S.E., Chou, R., Glanville, J., Grimshaw, J.M., Hróbjartsson, A., Lalu, M.M., Li, T., Loder, E.W., Mayo-Wilson, E., McDonald, S. and Moher, D. (2021), "The PRISMA 2020 statement: an updated guideline for reporting systematic reviews", *BMJ*, Vol. n71, doi: 10.1136/bmj.n71.

Publications Office of the European Union (2020), "Insights into the user experience of the European data portal", available at: https://data.europa.eu/en/publications/datastories/insights-user-experience-european-data-portal

Publications Office of the European Union (2021), "Open data maturity report", available at: https://data.europa.eu/doi/10.2830/394148

Purwanto, A., Zuiderwijk, A. and Janssen, M. (2020), "Citizen engagement with open government data: lessons learned from Indonesia's presidential election", *Transforming Government: People, Process and Policy*, Vol. 14 No. 1, pp. 1-30, doi: 10.1108/tg-06-2019-0051.

Ruijer, E.H. and Martinius, E. (2017), "Researching the democratic impact of open government data: a systematic literature review", *Information Polity*, Vol. 22 No. 4, pp. 233-250, doi: 10.3233/ip-170413.

Sieber, R.E. and Johnson, P.A. (2015), "Civic open data at a crossroads: dominant models and current challenges", *Government Information Quarterly*, Vol. 32 No. 3, pp. 308-315, doi: 10.1016/j.giq.2015.05.003.

Simperl, E. and Walker, J. (2020), *The Future of Open Data Portals*, Publications Office of the European Union, available at: https://data.europa.eu/doi/10.2830/879461

Susha, I., Grönlund, Å. and Janssen, M. (2015), "Organizational measures to stimulate user engagement with open data", *Transforming Government: People, Process and Policy*, Vol. 9 No. 2, pp. 181-206, doi: 10.1108/tg-05-2014-0016.

Veljković, N., Bogdanović-Dinić, S. and Stoimenov, L. (2014), "Benchmarking open government: an open data perspective", *Government Information Quarterly*, Vol. 31 No. 2, pp. 278-290, doi: 10.1016/j.giq.2013.10.011.

Venable, J. and Baskerville, R. (2012), "Eating our own cooking: toward a more rigorous design science of research methods", *Electronic Journal of Business Research Methods*, Vol. 10 No. 2, pp. 141-153.

Wilson, B. and Cong, C. (2021), "Beyond the supply side: use and impact of municipal open data in the US", *Telematics and Informatics*, Vol. 58, p. 101526, doi: 10.1016/j.tele.2020.101526.

Wirtz, B.W., Weyerer, J.C. and Rösch, M. (2019), "Open government and citizen participation: an empirical analysis of citizen expectancy towards open government data", *International Review of Administrative Sciences*, Vol. 85 No. 3, pp. 566-586, doi: 10.1177/0020852317719996.

Zhang, H., Bi, Y., Kang, F. and Wang, Z. (2022), "Incentive mechanisms for government officials' implementing open government data in China", *Online Information Review*, Vol. 46 No. 2, pp. 224-243, doi: 10.1108/oir-05-2020-0154.

Zhu, X. and Freeman, M.A. (2019), "An evaluation of US municipal open data portals: a user interaction framework", *Journal of the Association for Information Science and Technology*, Vol. 70 No. 1, pp. 27-37, doi: 10.1002/asi.24081.

Zuiderwijk, A. and Janssen, M. (2014), "Open data policies, their implementation and impact: a framework for comparison", *Government Information Quarterly*, Vol. 31 No. 1, pp. 17-29, doi: 10.1016/j.giq.2013.04.003.

Zuiderwijk, A., Janssen, M. and Davis, C. (2014), "Innovation with open data: essential elements of open data ecosystems", *Information Polity*, Vol. 19 Nos 1-2, pp. 17-33, doi: 10.3233/ip-140329.

Zuiderwijk, A., Janssen, M. and Susha, I. (2016), "Improving the speed and ease of open data use through metadata, interaction mechanisms, and quality indicators", *Journal of Organizational Computing and Electronic Commerce*, Vol. 26 Nos. 1-2, pp.116-146, doi: 10.1080/10919392.2015.1125180.

Corresponding author
Abdul Aziz can be contacted at: abdul.aziz@unizar.es